Analysis of Study Activities for Better Education Supporting Communication

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Abstract

This paper is centred on an analysis of study activities for suitable communication between students and teachers. The main objective of paper is to seek the optimal application structure of available study activities for effective learning. The multidimensional and object approach were selected as background for analyzed study activities with the support of Petri Nets. These activities are various exploration types from the Moodle system as a way to obtain student opinion about learning. The “Operating system” course and its students were dedicated for practical realization. The students evaluated, among other things, the analyses of operating system layers and Wiki or Glossary study activities via explorations. The result of this work is an analysis of available types of explorations in the Moodle system and their comparison with other study activities. Teachers can select from five pre-defined explorations in a short or long version. Quick access to student opinion and view on learning is comprised in the short version of exploration in seven items. Navigation is intuitive, for example Glossary or Wiki study activities creation. A good option is the ability to create one’s own exploration based on experiences with pre-defined explorations from the Moodle system. This analysis helps to better explore implementation in practice for optimal learning with communication. Linear and matrix algebra have a suitable place in this analysis of created simulations to general formal description. Given simulations were created based on the Petri Nets principle.

Keywords


Introduction

Learning and education uses specific activities with the aim to develop key skills and knowledge for all individuals. An important feature is the ability to communicate between students and teachers. Special skills are needed for communication in the virtual environment. (Bauerová, 2006; Horovitz, 2006) This ability carries appropriate significance for daily activities in firms and organizations to gain a competitive advantage in the global and information society. (Bonus adaptability, 2008) It is true that those who cannot perceive their actions, analyse and learn from them do not develop a personality. (řehánek, 2009) The market press is strong and ruthless; therefore, there is no place for mistakes and misunderstandings.

For objective transmission of information to improved knowledge, a high level of communication, presentation, and cooperation is needed. Teachers must understand student
requirements and expectations in university environments. They must use appropriate communication styles with interpersonal situations and know results of their communication (education) with links into practice and satisfied students. (Oblinger, D., G. and Oblinger, J., L., 2005) In this case we must think about the situation when student requirements are unrealistic or without interest to a given theme. On the other hand, teachers can rely on the fact that constant internal change and continual learning processes are based on both internal initiatives within the organization as well as external stimuli. (Pokorná and Sojková, 2009; Dlouhá, Zahradník, Hattanová, Dlouhý, 2006)

Effective communication in education must respect individual preferences and student abilities. It is important to realize that our conscious does not register everything, but only things we focus our attention on and what we can perceive. (Brixí, 2010; Eger, 2005) The required knowledge and skills effective in education are:

- Communication skills for effective contact with students,
- Presentation skills for ability to convince the other,
- Teamwork and ability to work in heterogeneous teams,
- Ability to solve problems and conflicts,
- Willingness to take risks, experiment, be creative to innovations,
- Perfect knowledge of technologies for combined usage by needs,
- Knowledge of the services provided,
- Knowledge of standards. (Zelený, 2011)

The optimal way to understand student opinion about educational materials, preferences, and priorities are various types of surveys, lists of questions, or explorations like study activities. As one of the well-known educational systems for educational support via web pages, the Moodle system offers these forms. (Moodle, 2011)

**Study activities for supporting communication**

Teachers can implement various types of study activities into a course for communication support between teachers to students. One of the needed study activities is exploration. Surveys like ATTLS (Attitudes Towards Thinking and Learning Survey) or COLLES (Constructivist On-line Learning Environment Survey) are accessible. The ATTLS activity contains suggestions of questions to get opinions that differ by empathy. COLLES offers the ability to evaluate course learning. Moodle (Moodle presentation, 2011) accesses a few variants:

- ATTLS with twenty items, Critical Incidents,
- Experiences, Ideas, Experiences and Ideas (COLLES).

Implementation is intuitive. All methods are based on completing the required fields like Name, Exploration type, Introductory text, Group mode, Visible, Identifier, and Mark category. Items Exploration type, Group mode, or Mark category allow easy selection through the use of menus. The use of these explorations brings question examples for surveys or lists of questions like:

- I spend my time looking for the problem.
- When I analyse something, it is important to remain as objective as possible.
- What helped you most for communication?
- What event surprised you the most.
Additional inspiration is form in the of answers, for example Almost never, Rarely, Sometimes, Often, Almost always, or the fact that questions with answers are grouped in the following sections: Severity, Reflecting the thinking, Interactivity, Support for teachers, Support for students, Interpretation. The question for this analysis is its usefulness and teacher perception in connection to other study activities in the accepted structure of the course.

Selected methods as background for analysis

Realized analysis is centred on optimally used accessible study activities from the Moodle system in order to support communication with students. The starting point for analytic work is the multidimensional approach and object access. Reasons for activation these ways have basic in needs the global and information society. The multidimensional approach brings a wide range of dimensions that affect information technology development. These dimensions are information, procedures, finance, organization, legislation, social and ethical aspects, software and hardware, and methodology. Object access is useful for work with Petri Net objects (Gold, 2004) like places, transitions, and edges.

The created model specifies the main characteristics of a given reality for the creation of explorations like ones from available study activities. This access enables to know the studied system better. The realized analysis is focused on the description of parallelisms for selected teacher activities with a classic analysis via linear and matrix algebra.

An analysis of study activities for the support of explorations

The realized analyses use Petri Nets in order to demonstrate offered activities and their mutual comparisons. The object of analysis was the exploration with links to other study activities like Glossary, Exploration, or Wiki. From this perspective it is interesting how the students perceive this method of analysis. The mentioned analysis is used for the formal description of selected layers of the openSolaris operating system.

The aim of this analysis is to evaluate education materials (analysis for the openSolaris operating system based on Petri Nets) and to clarify their perception by students. The benefit of this approach is that there was a mutual learning process with positive response. Students in communication with the teacher learn new theoretical knowledge and skills about operation systems.

Student perceptions of Petri net simulation in learning

New changes and the course of instruction were subject to review based on an exploration that students filled out at the end of the “Operating systems” course for full-time study. Several questions were asked and students chose from answers: Yes, Rather Yes, I do not know, Rather No, No. One of the questions was centred on Petri Net simulations that were added into the course within innovation: “How do you rate the usefulness of analysis using Petri Nets with animation?”. Petri Net simulations were created in the HPSim environment (Petri Nets Tools Database Quick Overview, 2011) in order to create models using Petri Nets. The selected topics include architecture, file system, process management, security, and user environment in the openSolaris operating system. The result of the student answers is given in Table 1 and Figure 1.

<table>
<thead>
<tr>
<th>Yes</th>
<th>Rather Yes</th>
<th>I do not know</th>
<th>Rather No</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>6</td>
<td>7</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>
The realized exploration shows that students received this way of analysis in the area operating systems well. On the other hand, accessed simulations need more interpretation and clarification because some students do not understand these models with links to theory and practice in the “Operating systems” course.

**Exploration study activities from the moodle system**

The above-mentioned exploration was accessed with the support of the Moodle system. On the basis of past experiences, the next step is naturally an analysis of available options from the area of surveys, and comparing with other study activities from the teacher’s point of view. The following rows show a practical application analysis with Petri Nets for creating an Exploration as available activities of the Moodle system. The given model describes reality with support of Petri Nets. Please see Figure 2. The start point is place P1_ListCourses. This place displays the screen with registered courses of teacher. The next route leads through the transition T1_Select_Course to place P2_Course_Identification. The transition rests in the selection of a course by the mouse and the scroll-bar. Place P2_Course_Identification displays on the screen a visually marked record of the course. Realized steps are intuitive. Model build follows defined places:

- P1_ListCourses – displays a list of registered courses.
- P2_Course_Identification – displays a visually marked name of the specified course.
- P3_Course_Information – displays specified groups of information, materials, and activities for editing.
- P4_Study_Activities – accesses offered activities.
- P5_Exploration – accesses needed information about Exploration.
- P6-1_Name, ..., P6-7_MarkCategory – accesses items for the creation of Exploration.
- P7_Course_DisplayContent – displays actual information about the course.

Needed transitions of the defined model are:

- T1_Select_Course – searches specified course (specified via scroll bar).
- T2_Display_CourseContent – selects needed information about selected course (selects course by mouse).
- T3_Editing_Course – specifies the edit mode of needed information, materials, and activities of a course (button Activate edit mode).
- T4_Add_Study_Activity – specifies the menu for the creation of a chats, database, exploration, forums, glossaries, lessons, list of questions, public inquiry, SCORM, tests, and Wikis (menu Add an activity).
- T5_Edit_ListItems-Exploration – accessible items for Exploration creation.
• T6_SaveAndReturnToCourse – confirms registered information created by edit process (button Save and Return to Course).

• T7_Return ListCourses – displays all registered courses of teacher for next course select (button Deactivate edit mode to end the editing, select next course via mouse and scroll bar).

The validity of the defined model is verified by starting the given simulation. A route cycle is built from place P1 via specified transitions and places. Places P6-1 to P6-7 illustrate items for Exploration editing. If the teacher ends the edit mode, it is important to confirm the “Deactivate edit mode” button. This activity is represented by transition T7. The next route returns to place P1.

Figure 2: Method simulation for creating an Exploration in the Moodle system.

Liner and matrix algebra for Petri nets simulation analyses

The above-mentioned model is a good way for further professional analysis based on linear and matrix algebra. The realized analysis of Petri Nets uses methods of linear algebra for work with matrix representation given structures (Markl, 2006) to describe the properties of these nets. Default structure of Exploration is defined as:

\[
\text{Exploration} = \sum_{i=1}^{7} P_{6-i}
\]  

(1)

where P6-i (pro i=1-7) are items for Exploration definition in the Moodle system. Further analysis uses an incidence matrix and set of reachable markings. To illustrate the incidence matrix and the reachable markings, please see Table 2.
Table 2. An analysis for a model with an incidence matrix and reachable markings.

<table>
<thead>
<tr>
<th>Incidence matrix</th>
<th>t1→M1</th>
<th>t2→M2</th>
<th>t3→M3</th>
<th>t4→M4</th>
<th>t5→M5</th>
<th>t6→M6</th>
<th>t7→M0</th>
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<tr>
<td>p1</td>
<td>-1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>p2</td>
<td>1</td>
<td>-1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>p3</td>
<td>0</td>
<td>1</td>
<td>-1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>p4</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>-1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>p5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>p6-1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>p6-2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>p6-3</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>p6-5</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>p6-6</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>1</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>p6-7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>-1</td>
<td>0</td>
</tr>
<tr>
<td>p7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>-1</td>
</tr>
</tbody>
</table>

Incidence matrix C is a matrix which makes the relation:

\[ C = C^+ - C^- \quad \text{Papik, 2010}, \]  

where C- is a backward incidence matrix, and C+ is a forward incidence matrix. The set of all reachable markings characterizes a set of all existing states. Specified places (p, for i=1 to 7) contain status information in the form of brands - tokens, and defined transitions (t; for j=1 to 7) reflect available changes. Incidence (amendment) matrix represents for the place as a whole (a positive number, negative number or zero) change in the number of brands located there. The set of reachable marking provides all states which the system can reach from the initial state.

Discussion

Accordingly, the analysis of other teacher activities from Moodle (such as Forum, Glossary, Survey, Test, or Wiki) is available. For example, creating the Glossary element involves a greater volume of work. Sixteen items are required to specify the Name, Description, Number items on page, Glossary type, Display alphabet, Evaluation with mark, or Common Settings. This study activity has an influence on the possibility to repeat, for example, main terms from the selected theme. The benefit is that students accept this activity very well, and they do not doubt its usefulness.

Another study activity for comparison is Survey. This study activity enables the creation of quick answers or feedback from students on needed matters like preferred test dates. This activity is also defined via sixteen items like Name, Describe, Choice limit, Option 1, ..., Option 5, or Common settings. The benefit of this activity is inconsistent based on links to the exploration. The Exploration study activity is very easily implemented via only seven items: Name, Type, Introductory text, Group mode, Visible, Identifier, and Mark category.

Conclusion

The realized analysis focuses on the usefulness of implemented study activities in the “Operating systems” course. The aim is to offer optimal educational materials and animation for the
effective description and interpretation of the given theme including evaluation. Students have various educational materials available in standard PDF documents. Other added activities are Glossary, Wiki, video-simulation for demonstration of practical work with UNIX operating systems, or simulations of selected operating system layers based on Petri Nets. A teacher’s natural requirement is being interested in the value for students with links to future innovation for better education and communication with students.

The analysis of available study activities from the Moodle system uses Petri Nets. This approach combines the advantages of graphic entry and simulation capabilities to easy comparison with other study activities. Presented analysis describes the complexity of the learning activities in order to facilitate better implementation of exploration in education. The teacher can select from five forms like ATTLS or COLLES. The required method is easy to implement into a course via only seven items by mostly predefined menus. This simplicity is visible with links to Glossary or Survey. These study activities are defined via sixteen items. The benefit of these activities is positive perception of education by students. The negative characteristic of exploration is the fact that the teacher cannot edit created explorations, but the teacher can use these activities for the inspiration of his or her own surveys or explorations. It is a way to identify and solve problems with links to theories in practice.

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